

GOOGLE NEXUS 5X & 6P MAINLINING EFFORT

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\$> WHOAMI



WHY?

NEXUS 5X SPECS

DISPLAY	Type	IPS LCD capacitive touchscreen, 16M colors
	Size	5.2 inches (~70.2% screen-to-body ratio)
	Resolution	1080 x 1920 pixels (~423 ppi pixel density)
	Multitouch	Yes
	Protection	Corning Gorilla Glass 3, oleophobic coating
PLATFORM	OS	Android OS, v6.0 (Marshmallow), upgradable to v7.1.1 (Nougat)
	Chipset	Qualcomm MSM8992 Snapdragon 808
	CPU	Hexa-core (4x1.4 GHz Cortex-A53 & 2x1.8 GHz Cortex-A57)
	GPU	Adreno 418
MEMORY	Card slot	No
	Internal	16/32 GB, 2 GB RAM
CAMERA	Primary	12.3 MP, f/2.0, 26mm, laser autofocus, dual-LED (dual tone) flash, check quality
	Features	1/2.3" sensor size, 1.55µm pixel size, geo-tagging, touch focus, face detection, HDR, panorama
	Video	2160p@30fps, 1080p@30fps, 720p@120fps, HDR, check quality
	Secondary	5 MP, f/2.0, 1/4" sensor size, 1.4 µm pixel size, HDR
SOUND	Alert types	Vibration; MP3, WAV ringtones
	Loudspeaker	Yes
	3.5mm jack	Yes
		- Active noise cancellation with dedicated mic
COMMS	WLAN	Wi-Fi 802.11 a/b/g/n/ac, dual-band, Wi-Fi Direct, DLNA, hotspot
	Bluetooth	v4.2, A2DP
	GPS	Yes, with A-GPS, GLONASS
	NFC	Yes
	Radio	No
	USB	v2.0, Type-C 1.0 reversible connector
FEATURES	Sensors	Fingerprint (rear-mounted), accelerometer, gyro, proximity, compass, barometer
	Messaging	SMS(threaded view), MMS, Email, Push Mail, IM
	Browser	HTML5
	Java	No
		- DivX/MP4/H.264 player - MP3/WAV/eAAC+/Flac player - Photo/video editor - Document editor
BATTERY		Non-removable Li-Po 2700 mAh battery

NEXUS 6P SPECS

DISPLAY	Type	AMOLED capacitive touchscreen, 16M colors
	Size	5.7 inches (~71.4% screen-to-body ratio)
	Resolution	1440 x 2560 pixels (~518 ppi pixel density)
	Multitouch	Yes
	Protection	Corning Gorilla Glass 4, oleophobic coating
PLATFORM	OS	Android OS, v6.0 (Marshmallow), upgradable to v7.0 (Nougat)
	Chipset	Qualcomm MSM8994 Snapdragon 810
	CPU	Octa-core (4x1.55 GHz Cortex-A53 & 4x2.0 GHz Cortex-A57)
	GPU	Adreno 430
MEMORY	Card slot	No
	Internal	32/64/128 GB, 3 GB RAM
CAMERA	Primary	12.3 MP, f/2.0, laser autofocus, dual-LED (dual tone) flash, check quality
	Features	1/2.3" sensor size, 1.55µm pixel size, geo-tagging, touch focus, face detection, HDR, panorama
	Video	2160p@30fps, 720p@240fps, check quality
	Secondary	8 MP, f/2.4, 1080p@30fps
SOUND	Alert types	Vibration; MP3, WAV ringtones
	Loudspeaker	Yes, with front stereo speakers
	3.5mm jack	Yes
		- 24-bit/96kHz - Active noise cancellation with dedicated mic
COMMS	WLAN	Wi-Fi 802.11 a/b/g/n/ac, dual-band, Wi-Fi Direct, DLNA, hotspot
	Bluetooth	v4.2, A2DP, LE
	GPS	Yes, with A-GPS, GLONASS
	NFC	Yes
	Radio	No
	USB	v2.0, Type-C 1.0 reversible connector
FEATURES	Sensors	Fingerprint (rear-mounted), accelerometer, gyro, proximity, compass, barometer
	Messaging	SMS(threaded view), MMS, Email, Push Mail, IM
	Browser	HTML5
	Java	No
		- Fast charging - MP4/H.264 player - MP3/WAV/eAAC+ player - Photo/video editor - Document editor
BATTERY		Non-removable Li-Po 3450 mAh battery
	Stand-by	Up to 440 h (3G)
	Talk time	Up to 23 h (3G)
	Music play	Up to 100 h

TERMINOLOGY

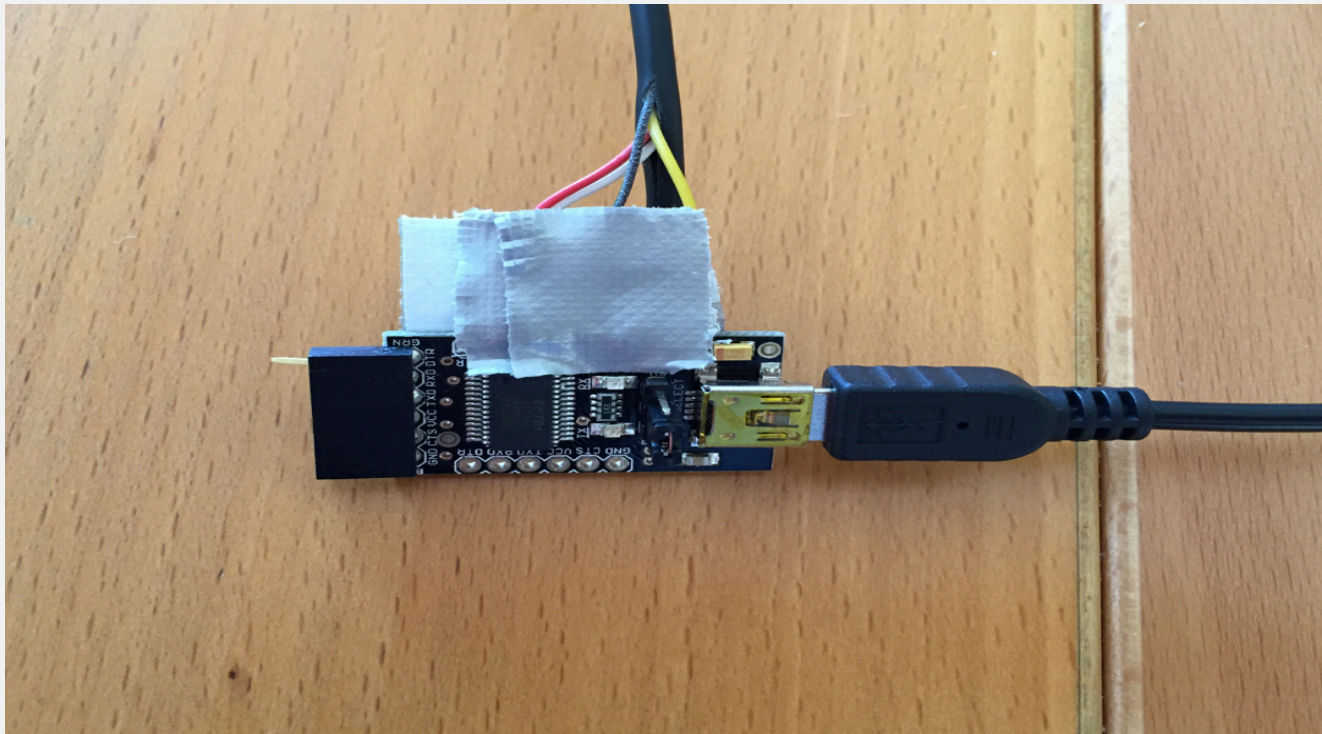
- Nexus 5X ↔ MSM8992 ↔ Snapdragon 808
- Nexus 6P ↔ MSM8994 ↔ Snapdragon 810
- MSM == Mobile Station Modem
- Linaro Integration branch
- Downstream
 - Msm 3.10
 - Msm 3.18

THE BEGINNING...

ELC 2016 – SAN DIEGO

- Mainline support of Nexus 5X ?
- Downstream working
- Community help / assistance

DEBUG CABLE



WHAT'S WORKING?

- Single CPU
- INITRD / RAMDISK
- Debug Serial
- Global Clocks
- SDHCI / MMC / onboard storage
- Pinctrl
- Bluetooth (WIP)

MAINLINE STATUS

Where can I get this cool new hotness?!?

```
$ git tag --contains a77a713395392a
```

```
v4.10-rc1
```

```
v4.10-rc2
```

```
v4.10-rc3
```

```
v4.10-rc4
```

```
v4.10-rc5
```

```
v4.10-rc6
```

UPDATING CLOCKS

Where are the values hiding?

```
static const struct freq_tbl ftbl_gcc_blspl_uart1_6_apps_clk[] = {
    F(3686400, P_GPLL0, 1, 72, 15625),
    F(7372800, P_GPLL0, 1, 144, 15625),
    F(14745600, P_GPLL0, 1, 288, 15625),
    F(16000000, P_GPLL0, 10, 1, 5),
    F(19200000, P_X0, 1, 0, 0),
    F(24000000, P_GPLL0, 1, 3, 100),
    F(25000000, P_GPLL0, 16, 1, 2),
    F(32000000, P_GPLL0, 1, 1, 25),
    F(40000000, P_GPLL0, 1, 1, 20),
    F(46400000, P_GPLL0, 1, 29, 500),
    F(48000000, P_GPLL0, 1, 3, 50),
    F(51200000, P_GPLL0, 1, 8, 125),
    F(56000000, P_GPLL0, 1, 7, 100),
    F(58982400, P_GPLL0, 1, 1152, 15625),
    F(60000000, P_GPLL0, 1, 3, 40),
    { }
};

static struct clk_rcg2 blspl_uart1_apps_clk_src = {
    .cmd_rcgr = 0x02044,
    .mnd_width = 16,
    .hid_width = 5,
    .parent_map = gcc_xo_gpll0_map,
    .freq_tbl = ftbl_gcc_blspl_uart1_6_apps_clk,
    .clkr.hw.init = &(struct clk_init_data){
        .name = "blspl_uart1_apps_clk_src",
        .parent_names = gcc_xo_gpll0,
        .num_parents = 2,
        .ops = &clk_rcg2_ops,
    },
};
```

(mainline) drivers/clk/qcom/gcc-msm8916.c

```
static struct clk_freq_tbl ftbl_gcc_blspl_uart1_6_apps_clk[] = {
    F( 3686400, gpll0, 1, 72, 15625),
    F( 7372800, gpll0, 1, 144, 15625),
    F( 14745600, gpll0, 1, 288, 15625),
    F( 16000000, gpll0, 10, 1, 5),
    F( 19200000, xo, 1, 0, 0),
    F( 24000000, gpll0, 1, 3, 100),
    F( 25000000, gpll0, 16, 1, 2),
    F( 32000000, gpll0, 1, 1, 25),
    F( 40000000, gpll0, 1, 1, 20),
    F( 46400000, gpll0, 1, 29, 500),
    F( 48000000, gpll0, 1, 3, 50),
    F( 51200000, gpll0, 1, 8, 125),
    F( 56000000, gpll0, 1, 7, 100),
    F( 58982400, gpll0, 1, 1152, 15625),
    F( 60000000, gpll0, 1, 3, 40),
    F_END
};

static struct rcg_clk blspl_uart1_apps_clk_src = {
    .cmd_rcgr_reg = BLSP1_UART1_APPS_CMD_RCGR,
    .set_rate = set_rate_mnd,
    .freq_tbl = ftbl_gcc_blspl_uart1_6_apps_clk,
    .current_freq = &rcg_dummy_freq,
    .base = &virt_bases[GCC_BASE],
    .c = {
        .dbg_name = "blspl_uart1_apps_clk_src",
        .ops = &clk_ops_rcg_mnd,
        VDD_DIG_FMAX_MAP2(LOW, 32000000, NOMINAL, 64000000),
        CLK_INIT(blspl_uart1_apps_clk_src.c),
    },
};
```

(downstream) drivers/clk/qcom/clock-gcc-8916.c

UPDATING CLOCKS

Where are the values hiding?

```
static struct branch_clk gcc_pcie_0_cfg_ahb_clk = {
    .cbr_reg = PCIE_0_CFG_AHB_CBR,
    .has_sibling = 1,
    .base = &virt_base,
    .c = {
        .dbg_name = "gcc_pcie_0_cfg_ahb_clk",
        .ops = &clk_ops_branch,
        CLK_INIT(gcc_pcie_0_cfg_ahb_clk.c),
    },
};
```

(downstream) drivers/clock/qcom/clock-gcc-8992.c

```
static struct clk_branch gcc_pcie_0_cfg_ahb_clk = {
    .halt_reg = 0x6b010,
    .clk = {
        .enable_reg = 0x6b010,
        .enable_mask = BIT(0),
        .hw.init = &(amp;struct clk_init_data){
            .name = "gcc_pcie_0_cfg_ahb_clk",
            .parent_names = (const char *[]){ "config_nco_clk_src" },
            .num_parents = 1,
            .flags = CLK_SET_RATE_PARENT,
            .ops = &clk_branch2_ops,
        },
    },
};
```

(Mainline) drivers/clock/qcom/gcc-msm8996.c

UPDATING CLOCKS

continued...

Downstream vs Upstream ?

```
[jmcnicol@mini-rhel WorkingMSM]$ vim drivers/clk/qcom/clock-gcc-8994.c
[jmcnicol@mini-rhel WorkingMSM]$ ls drivers/clk/qcom/clock*c
drivers/clk/qcom/clock-a7.c          drivers/clk/qcom/clock-gcc-8909.c    drivers/clk/qcom/clock-krait-8974.c  drivers/clk/qcom/clock-rpm-8916.c
drivers/clk/qcom/clock-alpha-pll.c   drivers/clk/qcom/clock-gcc-8916.c    drivers/clk/qcom/clock-krait.c        drivers/clk/qcom/clock-rpm-8936.c
drivers/clk/qcom/clock.c              drivers/clk/qcom/clock-gcc-8936.c    drivers/clk/qcom/clock-local2.c       drivers/clk/qcom/clock-rpm-8992.c
drivers/clk/qcom/clock-cpu-8936.c     drivers/clk/qcom/clock-gcc-8992.c    drivers/clk/qcom/clock-mmss-8992.c    drivers/clk/qcom/clock-rpm-8994.c
drivers/clk/qcom/clock-cpu-8939.c     drivers/clk/qcom/clock-gcc-8994.c    drivers/clk/qcom/clock-mmss-8994.c    drivers/clk/qcom/clock-rpm.c
drivers/clk/qcom/clock-cpu-8994.c     drivers/clk/qcom/clock-gcc-fsm9010.c  drivers/clk/qcom/clock-pll.c          drivers/clk/qcom/clock-voter.c
drivers/clk/qcom/clock-debug.c        drivers/clk/qcom/clock-gcc-tellurium.c drivers/clk/qcom/clock-pm.c            arch/arm64/boot/dts/freescale/
drivers/clk/qcom/clock-dummy.c        drivers/clk/qcom/clock-generic.c      drivers/clk/qcom/clock-rpm-8909.c     arch/arm64/boot/histicon/
```

```
[jmcnicol@mini-rhel msm]$ vim drivers/clk/qcom/gcc-msm8916.c
[jmcnicol@mini-rhel msm]$ ls drivers/clk/qcom/gcc-*.c
drivers/clk/qcom/gcc-apq8084.c  drivers/clk/qcom/gcc-ipq806x.c  drivers/clk/qcom/gcc-msm8660.c  drivers/clk/qcom/gcc-msm8960.c  drivers/clk/qcom/gcc-msm8994.c
drivers/clk/qcom/gcc-ipq4019.c  drivers/clk/qcom/gcc-mdm9615.c  drivers/clk/qcom/gcc-msm8916.c  drivers/clk/qcom/gcc-msm8974.c  drivers/clk/qcom/gcc-msm8996.c
[jmcnicol@mini-rhel msm]$
```

LESSONS LEARN

LESSONS LEARNED

Tips and tricks for those brave enough to repeat this!!

- Get things sent upstream ASAP (3.10 vs 4.5)
- Don't take on too much
- Keep your goals small and attainable
- Cheerleaders are helpful
- Don't just focus on getting X lines committed into the kernel. Helping others and the community is greatly appreciated and goes a long way.
- Community is not big bad and scary. People are quite cooperative / helpful if you play nice and are not an A\$\$H0I3

NEXT SUBSYSTEM?

SUBSYSTEM SELECTION?

- SDHCI done
- Screen / graphics 418 & 430 via Freedreno
- USB (good candidate)
- WIFI
- I2C
- SPI
- Modem
- Sound
- Camera
- Others..... ?

BLUETOOTH

(WIP...)

BLUETOOTH

Downstream investigation

- Qualcomm QCA6174 802.11ac Wi-Fi 2x2 MIMO Combo SoC
- ttyHS0 at MMIO 0xf995e000 (irq = 146) is a MSM HS UART
- Sequence of events:
 1. Enable BT via GPIO (*drivers/bluetooth/bluetooth-power.c*)
 2. Send reset (HCI_RESET 0x0C03) to /dev/ttyHS0
 3. Communication starts....

BLUETOOTH

Modifications for upstream

- PCIe clocks
- PCIe PHY clocks
 - PHY QMP not upstream
- PCIe QCA6174 supported via ath10k driver
 - Use latest ath10k on 3.10 using backports
- RPM SMD
- User space with Bluez and firmware



GETTING INVOLVED!

WISH LIST / TODO LIST / HELP LIST

- RAMDISK / InitRD > 2.1 MB booting
- Subsystem volunteers
- Hardware (Cables & Phones)
- Preconfigured VM to build AOSP?
- Help Jeremy investigate various subsystems downstream
- Kernel newbie
- Documentation published or subset

LINKS AND REFERENCES

- IRC: Freenode `##linux-msm` (yes, there are 2 #'s)
- Mailing lists: `linux-arm-kernel@vger.kernel.org`, `linux-arm-msm@vger.kernel.org`
- Git Repo's
 - MSM kernel 3.14 --> <https://us.codeaurora.org/cgit/quic/la/kernel/msm-3.14/>
 - MSM kernel 3.18 --> <https://us.codeaurora.org/cgit/quic/la/kernel/msm-3.18/>
 - Linaro <http://git.linaro.org/landing-teams/working/qualcomm/kernel.git>
- Initial Nexus mainline patches (<http://lists.infradead.org/pipermail/linux-arm-kernel/2016-July/442069.html>)
- <http://source.android.com/source/building-kernels.html>
- iFixit Teardown: <https://www.ifixit.com/Teardown/Nexus+5X+Teardown/51318>

LINKS AND REFERENCES – PART 2

- Dissecting the QCOM 1.7M line fork (<https://youtu.be/JnGL85SgIbA>)
- Debug Cable:
 - http://people.redhat.com/jmcnicol/nexus_debug/
 - <https://android.googlesource.com/device/google/debugcable/+/master>

THANK YOU

QUESTIONS & OPEN DISCUSSION